

## REMARKS

### I. Status of the Claims

Claims 1, 3-15, and 18-31 are pending. Applicants cancel claims 1, 3-15, and 18-31 in favor of new claims 32-46. Upon entry of the amendment, claims 32-46 will remain for consideration.

### II. Claim Amendments

Claims 32-46 are presented to better define the invention and distinguish it over the cited references. The original specification and claims support the new claims. In particular, the new claims require supports having a particular distribution of relatively small particle sizes combined with either a chromium compound (independent claim 32) or a metallocene (independent claim 40).

### III. Response to the Section 103 Rejection based on Derleth and Fottinger

Applicants traverse the rejection of claims 1, 3, 7-9, 12, 18-19, and 25 under 35 U.S.C. § 103(a) as unpatentable over Derleth et al. (U.S. Pat. No. 5,716,898) in view of Fottinger (U.S. Pat. Appl. Publ. No. 2002/0095014), and they respectfully ask the Examiner to reconsider and withdraw the rejection in view of their amendment and the following remarks.

The rejection is technically overcome by cancellation of claims 1, 3, 7-9, 12, 18-19, and 25. However, the Examiner is entitled to an explanation of how new claims 32-46 are distinguishable over this combination of references.

Derleth's teachings have been adequately discussed already. In short, Derleth teaches chromium catalysts that are supported on silica, but the silicas disclosed by Derleth do not have the particle size distributions required by Applicants' claims. In particular, new claims 32 and 40 require that the "finely particulate hydrogel," (i.e., the milled hydrogel from step b) comprise:

- at least 5% by volume of the particles, based on the total volume of the particles, have a particle size in the range from  $> 0 \mu\text{m}$  to  $\leq 3 \mu\text{m}$ ; and
- at least 40% by volume of the particles, based on the total volume of the particles, have a particle size in the range from  $> 0 \mu\text{m}$  to  $\leq 12 \mu\text{m}$ , and
- at least 75% by volume of the particles, based on the total volume of the particles, have a particle size in the range from  $> 0 \mu\text{m}$  to  $\leq 35 \mu\text{m}$ .

The requirements to have *at least 5 vol.% of particles having a particle size  $\leq 3 \mu\text{m}$*  and *at least 40 vol.% of particles having a particle size  $\leq 12 \mu\text{m}$*  are not fairly taught or suggested by Derleth, which teaches hydrogels having a 10-30  $\mu\text{m}$  range as most preferred.

Fottinger, newly applied, teaches Ziegler-Natta catalysts. These catalysts are prepared by contacting a tetravalent titanium compound (e.g.,  $\text{TiCl}_4$ ) with an inorganic metal oxide on which a magnesium compound has been deposited (Abstract). If desired, an electron donor compound can be added. Then, the intermediate is contacted with a polysiloxane to give the final Ziegler-Natta catalyst. Fottinger teaches that preferred inorganic metal oxides are spray-dried silica gels for which the primary particles "have a mean particle diameter of from 1 to 10  $\mu\text{m}$ , in particular from 1 to 5  $\mu\text{m}$ " (paragraph [0027]).

The Examiner argues that a skilled person would have found it obvious to modify Derleth's teachings by using the small particle size silica gel particles taught by Fottinger because spray-dried silica particles formed from small particle size components as taught by Fottinger have voids or channels that positively influence polymerization kinetics.

Applicants respectfully disagree with the obviousness conclusion, particularly as it relates to the amended claims. First, the Examiner should note that while Derleth teaches a way to make supports for use with chromium on silica ("chrome" or "Phillips" catalysts), Fottinger's disclosure is limited to Ziegler-

Natta catalysts, which utilize a Ti or V catalyst and an organometallic compound (dialkylmagnesium, trialkylaluminum) as a cocatalyst. The skilled person appreciates that the particular kind of support that works well with a Ziegler-Natta catalyst will not necessarily work well with a Cr catalyst. For instance, Ziegler-Natta catalysts are typically supported on small particle size supports, while Cr catalysts normally need to be activated in fluidized bed reactors, and this requires larger particles to avoid ejection from the reactor. Fottinger's Ziegler-Natta catalysts also require a siloxane component. It is unclear that omitting even just this component would provide an equivalent result.

Second, even though Fottinger teaches small particle sizes, the particle size distribution claimed by Applicants is more complex, with three specific requirements rather than just a single particle size range. Thus, the combined teachings of Derleth and Fottinger are still not specific enough to suggest using supports having the claimed particle size distribution.

Third, Applicants' claims as amended exclude Ziegler-Natta catalysts. In particular, new claim 32 is limited to chromium catalysts, and new claim 40 is limited to metallocenes. Thus, Fottinger is no longer particularly relevant to the claimed invention.

Finally, Applicants have provided ample evidence of a surprising benefit of using supports having the particularly claimed particle size distributions with both Cr and metallocene catalysts. Milling the hydrogel to provide a particle size distribution within the claimed range provides unexpected and valuable advantages. Applicants respectfully invite the Examiner to reconsider the results shown on pages 39-44 of the application. Five separate batches of hydrogels were milled to provide finely particulate hydrogels having the claimed particle size distribution (Table I, p. 39). Slurries of these hydrogels were spray dried, then used to support chromium compounds. The catalysts were activated and used to polymerize ethylene. As Table II (p. 41) shows, Applicants found that chromium catalysts of the invention, when compared with catalysts supported on ES 70X, a commercially available spray-dried support, provide a much lower proportion of "fines," i.e., polyethylene particles having a size  $< 125\ \mu\text{m}$  (0.51-1.3

wt.% versus 6.4 wt.%) and < 250  $\mu\text{m}$  (3-8 wt.% versus 20 wt.%). These results are not obvious from the combined teachings of Derleth and Fottinger.

Applicants' polymerizations using a supported metallocene (pp. 41-42) provide further evidence of patentability. As Table III (p. 43) shows, a single metallocene complex supported on three different commercially available silicas failed to provide productivities comparable to catalysts made from the same complex and supports made by Applicants' claimed process. The combined teachings of Derleth and Fottinger fail to predict the outcome of any experiment with metallocene catalysts because neither Derleth nor Fottinger uses metallocene catalysts.

Applicants provided additional evidence of patentability in showing that metallocene catalysts made according to the invention, when used in a gas-phase polymerization of ethylene, produce a smaller amount of fine particles in the discharge from a circulating gas cyclone ("CGC fines") and fewer large lumps when compared with a commercial counterpart (see Table IV, p. 44). Again, both Derleth, whose disclosure is limited to Phillips (Cr) catalysts, and Fottinger, whose disclosure is limited to Ziegler-Natta catalysts, fail to make these advantages of Applicants' invention apparent.

In sum, the combined teachings of Derleth and Fottinger do not make it obvious to make supported Cr or metallocene catalysts with supports that have the claimed particle size distributions. Moreover, Applicants provided ample experimental evidence to rebut any prima facie showing. The results demonstrate that Cr and metallocene catalysts that employ Applicants' supports outperform commercial alternatives in olefin polymerizations and provide benefits that could not have been predicted from the combined reference teachings. The Examiner should therefore reconsider and withdraw the Section 103 rejection.

IV. Response to the Section 103 Rejections based on Derleth in Combination with Other References

New claims 32 and 40 are independent and, as explained in Section III, are patentably distinct from the combined teachings of Derleth and Fottinger. Because all of the additional remaining claims (33-39 and 41-46) refer back to and incorporate the limitations of claim 32 or claim 40, these claims must also be patentable over the combined teachings of Derleth and Fottinger. The issue is whether any of the additional references cited, in combination with Derleth and Fottinger, would make claim 32 or 40 obvious.

None of Warthen, Hlatky, Mihan, or Brant, when combined with Derleth and Fottinger, provides specific enough information to suggest finely particulate hydrogels having the claimed particle size distribution. Warthen, for instance, (Ex. 1, col. 5) talks about a milled hydrogel having an average particle size of "about 6.5 $\mu$ ." The combined teachings of Derleth, Fottinger, and Warthen are thus insufficient to render Applicants' claim 32 or 40 (or any dependent claim) obvious. Moreover, none of Applicants' experimental findings could have been apparent from Warthen or its combination with Derleth and Fottinger.

A similar argument applies to the combination of Derleth and Fottinger with any of Hlatky, Mihan, and Brant. Hlatky's focus is metallocene complexes and borate activators, but finely particulate hydrogels are not used as supports. Mihan emphasizes MgO or ZnO antistatic agents for a gas-phase olefin polymerization. Brant also discusses a metallocene-catalyzed gas-phase process for olefin polymerization but does not describe preparation of finely particulate hydrogels as catalyst supports. Upon reconsideration, the Examiner should agree that none of the reference combinations fairly teaches or suggests Applicants' claimed process for making supported Cr or metallocene catalysts based on finely particulate hydrogels having the specific particle size distribution requirements of new claims 32 and 40.

V. Conclusion

In view of the remarks above, Applicants respectfully ask the Examiner to reconsider and withdraw the Section 103 rejections and pass the case to issue. Applicants invite the Examiner to telephone their attorney at (610) 359-2276 if he believes that a discussion of the application might be helpful.

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